

REMARKS

The specification has been amended to correct a grammatical error and spelling errors. Specifically, the tense of “enable” has been corrected, and “optimization” and “optimize” have been correctly spelled.

Claim 12 has been amended to include the preamble, “A laser machining device...” and claims 13-24 have been amended to include the corresponding preamble, “The laser machining device of claim...” In addition, claim 12 has been amended for grammar and to overcome the 35 USC §112 indefiniteness rejection by correcting “said” so that it is not capitalized. In addition, claim 12 has been amended to enable the limitations of the claim, for example, “is arranged for generating” has been amended to “generates” and “controlled to supply a secondary pulse train at output” has been amended to “controlled such that a secondary pulse train is output.” Support for the amendment is found in the original claims.

The transitional phrases of claims 13-15 have been amended to “further comprising.”

Further, claims 18 and 19 have been amended to enable the limitations of the claim. For example, “controlled so as to provide amplification pluses” has been amended to “controlled such that amplification pulses are provided.” “In order to modulate the amplitude of said secondary pulses” has been amended to “such that the amplitude of said secondary pulses is modulated.” Similarly, claim 24 has been amended to enable the limitations of the claim. In particular, “it is arranged for supplying pulses” has been changed to “said resonator supplies primary pulses” and “whose energy enables a hole to be drilled” has been amended to “having an energy such that a hole may be drilled.”

Claims 25-27 have been added. Support for the claims may be found on page 2, lines 26-30 describing the length of the primary and secondary pulses.

The Rejections

Claims 12-24 were rejected under 35 U.S.C. §112, second paragraph. As suggested by the Examiner, the Applicant has corrected the case of “said” in claim 12. In addition, the transitional phrases of claims 13-15 and 24 have been amended to “further comprising,” which Applicants assert clearly limits the base claim.

Claims 12-15, 18-21 and 24 were rejected under 35 U.S.C. §103(a) as being unpatentable over Applicant’s Admitted Prior Art (hereafter “AAPA”) in view of U.S. Patent No. 5,963,575 to Muller et al. (hereafter “Muller”) in view of U.S. Patent No. 7,149,231 to Afzal et al. (hereafter “Afzal”).

Claims 16 and 17 were rejected under 35 U.S.C. §103(a) as applied to claims 13 and 15 above, further in view of U.S. Patent No. 4,114,018 to Von Allmen et al. (hereafter “Von Allmen”).

Claims 22 and 23 were rejected under 35 U.S.C. §103(a) as applied to claims 12 and 21 above, further in view of U.S. Patent No. 6,366,596 to Yin et al. (hereafter “Yin”).

A. Applicants’ Arguments

35 USC §103(a)

A prima facie case of obviousness requires showing that the scope and content of the prior art teaches each and every element of the claimed invention. In re Oetiker, 24 U.S.P.Q.2d 1443 (Fed. Cir. 1992); In re Vaeck, 20 U.S.P.Q.2d 1438 (Fed. Cir. 1991). In addition, to establish obviousness, it must be shown that a person of ordinary skill in the art would have had reason to attempt to make the composition or device, or carry out the claimed process, and would have had a reasonable expectation of success in doing so. Pharmastem Therapeutics, Inc. v. Viacell, Inc., 491 F.3d 1342, 1360 (Fed. Cir. 2007) (citing KSR Int’l Co. v. Teleflex Inc., 127 S.Ct. 1727, 1740, 167 L.Ed.2d 705 (2007)).

The Examiner alleges that the specification of Applicant’s admitted prior art (hereafter, “AAPA”) describes known laser machining device features including diode

pumped solid state lasers with Q-switch resonator means, that Muller describes use of a resonator which produces a pulse length of 1 microsecond in column 3, line 22, and that the front page of Afzal describes a frequency converter modulation means 22. The Examiner concludes that “use of the instant claimed resonator and modulation means would have been obvious... in order to provide uniform output without encountering undesirable thermal effects.” However, the Applicants respectfully disagree that the combination of the cited art teaches the elements of the claims as arranged in the claims and that the combination would have been obvious. Further, Applicants assert that the combination would not result in the present invention.

For example, the combination of the cited art does not teach or suggest a resonator that “generates primary pulses having a length within or greater than the microsecond range” or using modulation means between the resonator and machining head “such that a secondary pulse train is output for each primary pulse entering” as does claim 12 of the present invention from which claims 13-27 depend.

Further, the Muller patent concerns a Q-switched laser system, which provides only primary pulses, that do not have a “length within or greater than the microsecond range” as does claim 12. As described in Muller column 1, lines 44-46, Muller uses a laser system in which a fiber resonator extension is provided for increasing the laser pulse length. Q-switched lasers typically generate pulses in the nanometer range, however, the laser system of the Muller patent is very specific with a fiber extension in the resonator, allowing seemingly to obtain pulses up to 1 μ s with a passive Q-switch. Thus, Muller does not teach a system which includes a resonator that “generates primary pulses having a length within or greater than the microsecond range.”

Moreover, the primary pulses of Muller are not further modulated by means arranged between the resonator and the output of the laser machining device as in claim 12 of the

present invention. While the Examiner asserts that Afzal discloses a “frequency converter modulation means 22”, the Applicants respectfully assert that Afzal describes these means in column 5, line 30 as “optical material[s] 22” that are used to generate a “second harmonic light” (see Afzal, column 8, lines 49). Unlike claim 12 of the present invention, which claims “modulation means ...controlled such that a secondary pulse train is output for each primary pulse” the frequency converter modulation means 22 of Afzal, described as possibly a “frequency doubling crystal of KTP” (column 5, line 31) does not increase the frequency of generated pulses in order to have more pulses with a smaller period, rather, the frequency doubling unit is used to generate second harmonic light, i.e. a laser beam with a greater light frequency, respectively a lower light period. Further, Applicants respectfully assert that the Afzal patent does not pertain to a laser machining device for drilling holes in components as does the present invention, thus, one of ordinary skill in the art would not be led to use the “non-linear optical material 22” of Afzal in order to improve the hole machining stability of the laser device for drilling holes in fluid injection device components of the present invention.

In the present case, the device of claim 12 is characterized by the laser resonator arranged for generating primary pulses having a length within or greater than the microsecond range. Thus, the laser resonator provides primary pulses with a time length relatively long and having enough energy for drilling a hole in fluid injection devices. Accordingly, the laser resonator of the present invention is preferably not equipped with a Q-switch, which typically generates pulses in the nanometer range, in order to generate with standard laser equipment primary pulses within or greater than the microsecond range. Further, the machining device of claim 12 includes modulation means arranged between the resonator and machining head, i.e. modulation means arranged downstream of the laser resonator. This modulation means modulates the incoming laser beam (i.e. the primary

pulses) so as to vary the power profile of each primary pulse such that secondary pulse trains of shorter length than the primary pulses are formed. The resulting pulse trains improve the efficiency and precision of the machining device in a manner which has not been disclosed and is not obvious in view of the Examiner's cited art.

CONCLUSION

In view of the present amendment, Applicants respectfully assert that claims 12-27 are in condition for allowance and a prompt notice of allowance is earnestly solicited. The below-signed attorney for Applicants welcomes any questions.

Respectfully submitted,

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